EXHIBIT A

a semiconductor chip to a lead frame with the adhesive member and molding at least the semiconductor chip and a bonded part between the semiconductor chip and the lead frame with a molding compound, in which the adhesive has a coming-out-length of not more than 2 mm and a water absorption rate of not more than 3 wt.%,

(b) a heat-resistant adhesive suitable for use in an adhesive member for the fabrication of a semiconductor package by bonding a semiconductor chip to a lead frame with the adhesive member and molding at least the semiconductor chip and a bonded part between the semiconductor chip and the lead frame with a molding compound, in which the adhesive has a coming-out length of not more than 2 mm, a water absorption rate of not more than 3 wt.% and a glass transition temperature of at least 200°C,

(c) a heat-resistant adhesive, in which the adhesive member is a composite adhesive sheet comprising a heat-resistant film and the heat-resistant adhesive applied in the form of a coating layer on one sueface or opposite suefaces of the heat-resistant film, and

(d) a heat-resistant adhesive, in which the adhesive member consists of the heat-resistant adhesive alone.

The heat-resistant adhesives according to the present invention have excellent package-crack resistance and are effective especially for the improvement of the reliability of semiconductor packages.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 schematically illustrates a semiconductor package fabricated by bonding a semiconductor chip to a lead frame with an adhesive member making use of a heat-resistant adhesive of the present invention and then molding the semiconductor chip and a bonded part between the semiconductor chip and the lead frame with a molding compound, in which the semiconductor chip is located below the lead frame;

FIG. 2 schematically illustrates a semiconductor package similar to that of FIG. 1 except that a semiconductor chip is located above a lead frame; and

FIG. 3 schematically illustrates a semiconductor package similar to that of FIG. 1 except that a semiconductor chip is located above a lead frame.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will hereinafter be described in detail.

No particular limitation is imposed on the specific heat-resistant adhesive employed in the present invention insofar as its water absorption rate and coming-out length are not more than 3 wt.% and not more than 2 mm. The heat-resistant adhesive which principle constituent is a heat-resistant thermoplastic

and the positions of the semiconductor chips bonded on the lead frames are different. Each semiconductor package has been fabricated by bonding the semiconductor chip to the lead frame with the adhesive member making use of the heat-resistant adhesive according to the present invention and then molding the semiconductor chip and a bonded part between the semiconductor chip and the lead frame with a molding compound.

In FIG. 1, the semiconductor is positioned below the lead frame.

In FIG. 2, the semiconductor is positioned above the lead frame.

In FIG. 3, the semiconductor is also positioned above the lead frame.

In FIGS. 1 to 3, there are shown the adhesive members at numeral 1, the semiconductor chips at numeral 2, the lead frames at numeral 3, wires at numeral 4 and the sealants at numeral 5.

The adhesive member making use of the heat-resistant adhesive according to the present invention are effective for bonding a semiconductor chip with a lead frame so as to fabricate the semiconductor package in LOC structure as illustrated in Fig. 1. The package of LOC (lead on chip) structure as shown in Fig. 1 is different from the COL (chip on lead) package of Fig. 2 and the package of Fig. 3 in that the rate of the volume occupied by the chip in the package is larger as compared with those of the two others. This is because (1) the package of Fig. 1 has not a tab while the package Fig. 3 has; and (2) the wire bonding is made

above the chip in the package of Fig. 1, while it is made on the suefaces of the chip in the packages of Figs. 2 and 3, thus saving a space for the wire bonding in addition to the space where the chip is mounted. This increases the rate of the space occupied by the chip in the package of Fig. 1 and accordingly reduces the thickness of the sealing material, increasing the possibility of occurrence of the package cracks due to the adhesive, as compared with the packages of Figs. 2 and 3. Thus, an effective measure for reducing the possibility of occurrence of the cracks has been awaited. The adhesive of the present invention is especially effective for prevention or reduction of occurrence of the cracks in the package as shown in Fig. 1.

Without needing being limited thereto, it can also be effectively applied for the bonding of objects such as ceramic plates, metal plates, metal foils, plastic films, plastic plates and laminates.

Upon bonding each of such objects, the object can be bonded to another object by coating the adhesive onto the first-mentioned object or where the adhesive is in the form of a sheet, interposing it between the objects, heating the adhesive at a temperature equal to or higher to the softening point of the adhesive and then applying pressure.

The present invention will hereinafter be described specifically by the following examples. It should however be borne in mind that this invention is by no means limited to or by the examples.

Example 1

Class | ISSUE CLASSIFICATION

UTILITY SERIAL NUMBER 08 218544	PATENT DATE	PATENT NUMBER

SERIAL NUMBER	FILING DATE	CLASS	SUBCLASS	GROUP ART UNIT	EXAMINER
08/218,544	03/28/94	~~156~~ 428	349	~~1301~~ 1512	Delaney

APPLICANTS: HIDEKAZU MATSUURA, OYAMA-SHI, JAPAN; YOSHIHIDE IWAZAKI, TSUKUBA-SHI, JAPAN; NAOTO OHTA, TSUKUBA-SHI, JAPAN.

CONTINUING DATA******************** /NONE
VERIFIED

FOREIGN/PCT APPLICATIONS**********
VERIFIED

JAPAN	5-91899	03/29/93
JAPAN	5-91870	03/29/93
JAPAN	6-25939	01/31/94

Foreign priority claimed [x] yes [ ] no; 35 USC 119 conditions met [ ] yes [x] no; Verified and Acknowledged — Examiner's Initials	AS FILED →	STATE OR COUNTRY	SHEETS DRWGS.	TOTAL CLAIMS	INDEP. CLAIMS	FILING FEE RECEIVED	ATTORNEY'S DOCKET NO.
		JPX	1	10	2	$710.00	7426014

ADDRESS:
PENNIE & EDMONDS
1155 AVENUE OF THE AMERICAS
NEW YORK, NY 10036

TITLE: HEAT-RESISTANT ADHESIVE

U.S. DEPT. of COMM.-Pat. & TM Office-PTO-436L (rev. 10-78)

PARTS OF APPLICATION FILED SEPARATELY

Applications Examiner

NOTICE OF ALLOWANCE MAILED

Assistant Examiner

CLAIMS ALLOWED

Total Claims	Print Claim

ISSUE FEE

Amount Due	Date Paid

DRAWING

Sheets Drwg.	Figs. Drwg.	Print Fig.

Primary Examiner

ISSUE BATCH NUMBER

PREPARED FOR ISSUE

Label Area

WARNING: The information disclosed herein may be restricted. Unauthorized disclosure may be prohibited by the United States Code Title 35, Sections 122, 181 and 368. Possession outside the U.S. Patent & Trademark Office is restricted to authorized employees and contractors only.

Class | ISSUE CLASS

UTILITY SERIAL NUMBER 08/514353	PATENT DATE	PATENT NUMBER

SERIAL NUMBER	FILING DATE	CLASS	SUBCLASS	GROUP ART UNIT	EXAMINER
08/514,353	07/27/95	428	349.000	1501	

APPLICANTS
HIDEKAZU MATSUURA, OYAMA-SHI, JAPAN; YOSHIHIDE IWAZAKI, TSUKUBA-SHI, JAPAN; NAOTO OHTA, TSUKUBA-SHI, JAPAN.

CONTINUING DATA
VERIFIED THIS APPLN IS ... 08/218,544 03/28/94 ...
KMD

FOREIGN/PCT APPLICATIONS
VERIFIED JAPAN ... 03/29/..
... 03/29/..
... 0./31/..
KMD

Foreign priority claimed ☑ yes ☐ no 35 USC 119 conditions met ☑ yes ☐ no Verified and Acknowledged KMD Examiner's Initials	AS FILED	STATE OR COUNTRY	SHEETS DRWGS.	TOTAL CLAIMS	INDEP. CLAIMS	FILING FEE RECEIVED	ATTORNEY'S DOCKET NO.
		JPX	1	13	2	$730.00	

ADDRESS
PENNIE AND EDMONDS
1155 AVENUE OF THE AMERICAS
NEW YORK NY 10036

TITLE
HEAT-RESISTANT ADHESIVE

U.S. DEPT. OF COMM./ PAT. & TM—PTO-436L (Rev.1

08/218544 FJK 7

PARTS OF APPLICATION FILED SEPARATELY

Applications Examiner

NOTICE OF ALLOWANCE MAILED

Assistant Examiner

CLAIMS ALLOWED

Total Claims	Print Claim

ISSUE FEE

Amount Due	Date Paid

DRAWING

Sheets Drwg.	Figs. Drwg.	Print Fig.

Primary Examiner

ISSUE BATCH NUMBER

PREPARED FOR ISSUE

Label Area

WARNING: The information disclosed herein may be restricted. Unauthorized disclosure may be prohibited